

a WHAT IS CLAIMED IS:
CLAIMS:

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1. A vaccine composition for the prophylaxis or treatment of infection in an animal or bird by *Lawsonia intracellularis* or related microorganism, said vaccine composition comprising an immunogenic, non-pathogenic form of *L. intracellularis* or related microorganism or an immunogenic component thereof and one or more carriers, diluents and/or adjuvants suitable for veterinary or pharmaceutical use.
 2. A vaccine composition according to claim 1 wherein the composition is for the prophylaxis or treatment of infection in pigs by *L. intracellularis* or related microorganism.
 3. A vaccine composition according to claim 2 wherein the non-pathogenic form of *L. intracellularis* or related microorganism is an attenuated strain of the microorganism.
 4. A vaccine composition according to claim 2 wherein the non-pathogenic form of *L. intracellularis* or related microorganism is a killed preparation of the microorganism.
 5. A vaccine composition according to claim 4 wherein the non-pathogenic form of *L. intracellularis* is a formalin-killed preparation of the microorganism.
 6. A vaccine composition according to claim 1 or 2 wherein said composition comprises a peptide, polypeptide, protein, carbohydrate, lipid or nucleic acid molecule or a combination thereof from *L. intracellularis* or related microorganism in an amount effective to induce a protective immune response agent *L. intracellularis* or related microorganism.
 7. A vaccine composition according to claim 6 wherein the composition comprises a peptide, polypeptide, protein or a derivative thereof from *L. intracellularis* or related microorganism.

Sub 8. A vaccine composition according to claim 7 wherein the peptide, polypeptide or protein is in recombinant form.

9. A vaccine composition according to claim 7 or 8 wherein the composition comprises a refolding/heatshock protein, a flagellar basal body rod protein, S-adenosylmethionine: tRNA ribosyltransferase-isomerase, autolysin, enoyl-(acyl-carrier-protein) reductase or a glucarate transporter or derivative thereof.

10. A vaccine composition according to claim 9 wherein the protein is GroEL having an amino acid sequence set forth in SEQ ID NO:2 or is a protein having at least about 40% similarity thereto.

11. A vaccine composition according to claim 9 wherein the protein is GroES having an amino acid sequence set forth in SEQ ID NO:4 or is a protein having at least about 40% similarity thereto.

12. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:1 or a sequence having at least about 40% similarity thereto.

13. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:3 or a sequence having at least about 40% similarity thereto.

14. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:5 or a sequence having at least about 40% similarity thereto.

15. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:6

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or a sequence having at least about 40% similarity thereto.

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16. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:8 or a sequence having at least about 40% similarity thereto.

17. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:11 or a sequence having at least about 40% similarity thereto.

18. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:13 or a sequence having at least about 40% similarity thereto.

19. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:15 or a sequence having at least about 40% similarity thereto.

20. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:17 or a sequence having at least about 40% similarity thereto.

21. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:18 or a sequence having at least about 40% similarity thereto.

22. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:19 or a sequence having at least about 40% similarity thereto.

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23. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:20 or a sequence having at least about 40% similarity thereto.

24. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:21 or a sequence having at least about 40% similarity thereto.

25. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:22 or a sequence having at least about 40% similarity thereto.

26. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein having an amino acid sequence of SEQ ID NO:7 or a sequence having at least 40% similarity.

27. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein having an amino acid sequence of SEQ ID NO:9 or a sequence having at least 40% similarity.

28. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein having an amino acid sequence of SEQ ID NO:10 or a sequence having at least 40% similarity.

29. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein having an amino acid sequence of SEQ ID NO:12 or a sequence having at least 40% similarity.

30. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein having an amino acid sequence of SEQ ID NO:14 or a

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sequence having at least 40% similarity.

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31. A vaccine composition according to claim 8 wherein the composition comprises a peptide, polypeptide or protein having an amino acid sequence of SEQ ID NO:16 or a sequence having at least 40% similarity.

32. A method for vaccinating an animal or bird against infection by *L. intracellularis* or related microorganism or treating an animal or bird infected by *L. intracellularis*, said method comprising administering to said animal or bird an effective amount of a non-pathogenic form of *L. intracellularis* or related microorganism or an immunogenic component thereof for a time and under conditions sufficient to induce a protective immune response against *L. intracellularis* or related microorganism.

33. The A method according to claim 32 wherein the animal is a pig.

34. The A method according to claim 33 wherein the non-pathogenic form of *L. intracellularis* or related microorganism is an attenuated strain of the microorganism.

35. The A method according to claim 33 wherein the non-pathogenic form of *L. intracellularis* or related microorganism is a killed preparation of the microorganism.

36. The A method according to claim 35 wherein the non-pathogenic form of *L. intracellularis* is a formalin-killed preparation of the microorganism.

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37. A method according to claim 32 and 33 wherein said immunogenic component comprises a peptide, polypeptide, protein, carbohydrate, lipid or nucleic acid molecule or a combination thereof from *L. intracellularis* or related microorganism in an amount effective to induce a protective immune response against *L. intracellularis* or related microorganism.

38. The A method according to claim 37 wherein said immunogenic component comprises a

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peptide, polypeptide, protein or a derivative thereof from *L. intracellularis* or related microorganism.

39. A method according to claim 38 wherein the peptide, polypeptide or protein is in recombinant form.

40. A method according to claim 29 or 30 wherein the immunogenic component is a refolding/heatshock protein, a flagellar basal body rod protein, S-adenosylmethionine: tRNA ribosyltransferase-isomerase, autolysin, enoyl-(acyl-carrier-protein) reductase or a glucarate transporter or derivative thereof.

41. A method according to claim 40 wherein the protein is GroEL having an amino acid sequence set forth in SEQ ID NO:2 or is a protein having at least about 40% similarity thereto.

42. A method according to claim 40 wherein the protein is GroES having an amino acid sequence set forth in SEQ ID NO:4 or is a protein having at least about 40% similarity thereto.

43. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:1 or a sequence having at least about 40% similarity thereto.

44. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:3 or a sequence having at least about 40% similarity thereto.

45. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:5 or a sequence having at least about 40% similarity thereto.

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46. ~~The~~ A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:6 or a sequence having at least about 40% similarity thereto.

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47. ~~The~~ A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:8 or a sequence having at least about 40% similarity thereto.

48. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:11 or a sequence having at least about 40% similarity thereto.

49. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:13 or a sequence having at least about 40% similarity thereto.

50. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:15 or a sequence having at least about 40% similarity thereto.

51. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:17 or a sequence having at least about 40% similarity thereto.

52. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:18 or a sequence having at least about 40% similarity thereto.

53. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:19

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or a sequence having at least about 40% similarity thereto.

54. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:20 or a sequence having at least about 40% similarity thereto.

55. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:21 or a sequence having at least about 40% similarity thereto.

56. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein encoded by a nucleotide sequence comprising SEQ ID NO:22 or a sequence having at least about 40% similarity thereto.

57. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein comprising an amino acid sequence set forth in SEQ ID NO:7 or having at least 40% similarity thereto.

58. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein comprising an amino acid sequence set forth in SEQ ID NO:9 or having at least 40% similarity thereto.

59. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein comprising an amino acid sequence set forth in SEQ ID NO:10 or having at least 40% similarity thereto.

60. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein comprising an amino acid sequence set forth in SEQ ID NO:12 or having at least 40% similarity thereto.

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61. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein comprising an amino acid sequence set forth in SEQ ID NO:14 or having at least 40% similarity thereto.

62. A method according to claim 38 wherein the immunogenic component comprises a peptide, polypeptide or protein comprising an amino acid sequence set forth in SEQ ID NO:16 or having at least 40% similarity thereto.

63. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:1 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:1 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

64. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:3 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:3 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

65. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:5 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:5 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

66. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:6 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:6 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein

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from *L. intracellularis* or related microorganism.

67. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:8 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:8 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

68. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:11 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:11 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

69. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:13 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:13 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

70. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:15 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:15 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

71. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:17 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:17 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein

from *L. intracellularis* or related microorganism.

72. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:18 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:18 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

73. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:19 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:19 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

74. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:20 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:20 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

75. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:21 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:21 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein from *L. intracellularis* or related microorganism.

76. An isolated nucleic acid molecule comprising a nucleotide sequence as set forth in SEQ ID NO:22 or a nucleotide sequence having at least 40% similarity to the nucleotide sequence set forth in SEQ ID NO:22 and which is capable of hybridizing thereto under low stringency conditions and which encodes an immunogenic peptide, polypeptide or protein

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from *L. intracellularis* or related microorganism.

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77. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:1 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:1 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

78. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:3 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:3 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

79. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:5 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:5 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

80. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:6 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:6 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

81. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:8 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:8 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective

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immune response against *L. intracellularis* or related microorganism.

82. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:11 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:11 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

83. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:13 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:13 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

84. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:15 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:15 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

85. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:17 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:17 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

86. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:18 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:18 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a

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protective immune response against *L. intracellularis* or related microorganism.

87. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:19 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:19 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

88. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:20 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:20 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

89. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:21 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:21 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

90. A genetic vaccine comprising a DNA sequence having a nucleotide sequence set forth in SEQ ID NO:22 or having at least 40% similarity thereto or is capable of hybridizing to SEQ ID NO:22 under low stringency conditions, said DNA sequence capable of expression in a pig to produce an amount of a peptide, polypeptide or protein effective to induce a protective immune response against *L. intracellularis* or related microorganism.

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